

hours after apparent death. The action of the nitrite of amyl in causing suspended animation seemed to be like cold. It prevented the pectous change of colloidal matter, and so prevented rigor mortis, coagulation of blood, and solidification of nervous centres and cords. So long as this change was suspended return of vital function was possible. When the pectous change occurred, all was over, and resolution into new forms of matter by putrefaction was the result.

From the analogy of some of these symptoms from nitrite of amyl with the symptoms of the disease called catalepsy, I have ventured to suggest that, under some abnormal conditions, the human body itself, in its own chemistry, may produce an agent which causes the suspended life observed during the cataleptic condition.

Woorali in a similar manner suspends vital function ; but as the influence of this agent has been more frequently under observation from other physiologists, I leave it with this mention of it.

Chloral Hydrate has many of the properties of the other substances named above in its power of suspending life. At the meeting of the British Association at Exeter, at which I made the earliest report in this country of Liebreich's remarkable discoveries, some pigeons, which had been put to sleep by the needle-injection of a large dose of chloral, fell into such complete resemblance of death, that they passed among an audience containing many physiologists and other men of science for dead. For my own part I could detect no sign of life in them, and they were laid in one of the out-offices of the museum of the infirmary as dead. In this condition they were left late at night, but in the following morning they were found alive and as well as if nothing hurtful had happened to them.

Cyanogens. — Cyanogen gas and hydrocyanic acid, deadly poisons as they are, have the power in a singular degree of suspending animation. Combined with a sufficient degree of cold to prevent their evaporation from the body, their suspending power is of the most definite kind. In the laboratory of a large drug establishment a cat, by request of its owner, was killed, as it was assumed, instantaneously and painlessly by a large dose of Scheele's acid. The animal appeared to die without a pang, and presenting every appearance of death was laid in a sink to be removed on the next morning. At night the animal was lying still in form of death in the tank beneath a tap. In the morning it was found alive and well, but with the fur wet from the dropping of water from the tap. This fact was communicated to me by the eminent chemist under whose direct observation it occurred, in corroboration of an observation of mine similar in character.

Alcohol is another substance which holds the vital functions in suspense for long periods of time, the muscles retaining their excitability. In animals killed by alcohol in combination with cold, two influences which act powerfully together in the same direction, I found the muscular excitability could be retained at freezing-point for several hours even in birds. A remarkable similar experience, which I have elsewhere recorded, was obtained in the case of an intoxicated man who, while on the ice at the Welsh Harp lake, fell into the water through a breakage in the ice, and who for more than fifteen minutes was completely immersed. This man was extricated to all appearances dead, but under artificial respiration, carried out by my friend Dr. Belgrave, of Hendon, he was restored to consciousness and lived for several hours.

Oxygen. — It is not a little singular that pure oxygen gas possesses the power of suspending life, at all events in muscular fibre, when it is aided by condensation produced by cold ; but I am on new ground here, with which I am not so conversant at present as I hope to be.

I have now shown as briefly as was possible that much

is known in the world of science in respect to suspension of animal life by artificial means. It will be seen that cold as well as various chemical agents has this power ; and it is worthy of note that cold, together with the agents named, is antiseptic, as though whatever suspended living action, suspended also by some necessity or correlative influence the process of putrefactive change. Hence the influence I drew in my lecture at the Society of Arts, that it was within the range of experiment to preserve the structures of dead animals in a form of suspended molecular life.

If the experiments reported from Brisbane be reliable it is clear, I think, that what has been done has been effected by the combination of one of the chemical agents above named, or of a similar agent, in combination with cold, the efficiency of which combination we have seen in many of the experimental facts referred to above. The only question that exists as of moment is, not whether a new principle has been developed, but whether, in matter of detail, a new product has been discovered which, better than any of the agents we already possess, destroys and suspends animation. In organic chemistry, there are, I doubt not, hundreds of substances which, like mandragora and nitrite of amyl, would suspend the vital process, and it may be that a new experimenter has met with such an agent. It is not incredible indeed that the Indian Fakirs possess a vegetable extract or essence which possesses the same power, and by means of which they perform their as yet unexplained feat of prolonged living burial : but I confess, on reading the Australian narrative, there is nothing suggested by it to my mind that might not be produced by agents already known. Making allowance for what is clearly a very enthusiastic description, there is nothing in an experiment related as made on a dog that might not have been produced by the subcutaneous injection of hydrate of chloral ; neither is there anything in other experiments that might not follow from the injection of chloral or woorali in a cold atmosphere. At the same time it is not also unreasonable to infer that a new product has been found which surpasses any we possess, and suspends animation for a longer period. My faith is most shaken first by the statement that the agent referred to is a secret, for men of true science know no such word ; secondly, that the experimenter has himself to go to America to procure more supplies of his agents ; and thirdly, that he requires two agents, one of which is antidotal to the other. I can understand the production of a definite effect from a single ; and others as well as myself have made out a great many facts respecting the antagonism of one agent by another. But in our researches on antagonistic physiological substances we require the agencies of absorption and circulation of the antidote, and how in a body bereft of motion and practically dead such absorption can take place I am unable to divine.

But even should the description given by the Australian journalist prove overdrawn or imaginative, I am not sorry it has appeared, since it has afforded a reason for relating in a plain and faithful manner to what actual extent human knowledge has been advanced by experiment on the subject under consideration. This duty, though it be but preliminary, is important as an introduction to those great events which in the future are sure to come from the positive results that have already been secured, and for which the world should be prepared, without anxiety or amazement.

BENJAMIN WARD RICHARDSON

NOTES

THE death is announced of William Froude, F.R.S., a name familiar to our readers in connection with experiments on wave-resistances and the form of ships. Mr. Froude, who had long

been in weak health, left England in November last year, in H.M.S. *Boadicea*, for a holiday cruise to the Cape, and he died from dysentery on the 4th inst., at Simon's Town. We defer further notice of Mr. Froude's life and work till next week.

ANOTHER advance of the greatest importance has been made by the U.S. Signal Service in the department of practical meteorology. In the *Daily Graphic* for May 9, published in the afternoon at New York, is a map of the principal portion of the United States, with the weather conditions of the same morning. The map gives in distinct outline the lines of equal atmospheric pressure and of the temperatures over the United States, with the prevailing directions of the wind and the general weather conditions. By the aid of this map, which it is proposed to make a regular feature of the *Graphic*, any one can form a fair idea of the weather changes in any specified locality for some days to come. The observations indicated in the map were made at all the signal stations of the U.S. Government at thirty-five minutes past seven on the morning of the 9th, and having been collated at the central office in Washington at nine o'clock, were transmitted specially by telegraph to the *Graphic* by ten o'clock. All the details of the map have been carefully considered and are easily intelligible to any reader after a little study. The importance of this step cannot be overrated, and we only wish we saw the *Pall Mall* and other evening papers following the excellent example of their New York contemporary.

PROF. ASAPH HALL has been elected a corresponding member by the Paris Academy of Science to fill the place in the astronomical section vacant by the death of M. Santini.

THERE is being erected at Meudon a large construction in connection with the Physical Observatory, where a large refracting telescope will be fitted up. During the time that the works are being carried on M. Janssen continues his solar photography on the site where his instruments have been established, in a part of the old Château. The diameter of the photographs obtained by direct operation is now 50 centimetres, and the time of exposure to solar radiation diminished to $\frac{1}{2000}$ th of a second. The interval of time between two successive operations has been reduced to two minutes by the application of the revolver system. Although the two images may represent the surface of the sun at periods so near each other, M. Janssen has discovered that there is always a striking difference in the two images. It must be considered as proved by these observations that no spot on the sun can be regarded as being in a state of quiescence, even during so short a period, and that the changes are important enough to be perceived at the distance of the sun viewed from the earth, although the smallest spot observable must be regarded as having a surface larger than the whole of France, a second of arc on the sun being equal to the distance between Paris and Marseilles.

ADMIRAL MOUCHEZ has almost completed his museum of astronomy in one of the rooms of the Paris Observatory. Exclusive of the portraits of Bouvard, Arago, Leverrier, Cassini, and other directors, a series of the principal celestial objects has been painted on the walls by talented artists. In the middle is a glass case in which a number of instruments used by astronomers of former ages are exhibited. M. Mouchez intends to publish a monthly periodical, which will be called *Journal d'Astronomie*. A part will be reserved for the original communications of the astronomers of the Paris Observatory, and part devoted to reviewing foreign astronomical periodicals.

THE Paris Anthropological Society has recently awarded prizes as follows:—The Godard Prize (500 francs and a silver-

gilt medal) to Dr. Le Bon, for a work on the development of the cranium according to civilisation, age, and sex; two honourable mentions (with bronze medals) to M. Ujfalvy, for the first volume of his "Journey in Turkestan," and M. Zaborowski, for his "Manual of Prehistoric Archaeology;" the prize in French Ethnology to Dr. Chervin, for his statistical works; and honourable mention to M. Rivière for his prehistoric researches.

SIR WILLIAM THOMSON gave some valuable evidence on Friday before the Select Committee engaged in considering the subject of the electric light. He said that whereas one-horse-power of energy would only produce 12-candle gas light, it might produce 2,400-candle electric light. "The upshot of the experiments made at the factory of Messrs. Siemens, at Woolwich, and at the natural philosophy class of the University of Edinburgh, was that, allowing the practical estimate of one-horse-power applied in driving the engine, it had produced 1,200 candles of actual visible electric light, half the gross energy going to produce the light while the other half was lost in heating the machine and the wires. As the electric light was such an economical producer he anticipated that it had a great and immediate future before it. He believed before long it would be used in every case where a fixed light was required, whether in large rooms or small ones—even in passages and staircases of private dwellings. There was immense promise in the actual work carried out by practical men in the present day. There was a prodigiously greater economy in the transmission of mechanical force into energy in the case of the electric light than in the case of gas. With regard to regulators for the electric light, he had seen one the previous day—the Siemens regulator—which gave a steady, pure, and quiet light. The electric light was especially adapted for being placed high where it illuminated a wide area. It might be put upon an iron pole raised 60 feet high, or the old French plan of swinging a lamp on a wire from one side of the street to the other might be followed with advantage. Such a plan would be useful in doing away with the necessity for opal globes, which destroyed a large quantity of the illuminating quality of the light. Indeed, he was surprised that these globes had ever been used, wasting as they did 50 or 60 per cent. of the illuminating power. He considered that the advantages of using the electric light within buildings would be very great, because of the small effect it would have when compared with gas in heating and vivifying the atmosphere. In the case of electricity, the waves of light only became converted into sensible heat, not in the air, but on the ceiling or walls and floor of the room after they had done their work. With regard to the subdivision of the light, according to practical experiments, if the same amount of energy that was used in producing one large light was employed in producing ten feeble lights, none of those lights gave one-tenth of the amount of illumination of the one large concentrated light. Still there was nothing mathematically impossible in the matter, and it was quite possible that a plan of subdivision might be found by which the ten feeble lights would give a sum of illumination equal to that of the one larger light. He considered that the electric light as now developed was fit for use in large rooms. He was also of opinion that a great deal of natural energy which was now lost might be advantageously applied in the future to lighting and manufactures. There was a deal of energy in waterfalls. In the future, no doubt, such falls as the Falls of Niagara would be extensively used—indeed, he believed the Falls of Niagara would in the future be used for the production of light and mechanical power over a large area of North America. The electricity produced by them might be advantageously conducted for hundreds of miles, and the manufactories of whole towns might be set in motion by it. Powerful copper conductors would have to be used—conductors of a tubular form

with water flowing through them to keep them cool. There would be no limit to the application of the electricity as a motive power; it might do all the work that could be done by steam-engines of the most powerful description. It seemed to him that legislation, in the interests of the nation and in the interests of mankind, should remove as far as possible all obstacles such as those arising from vested interests, and should encourage inventors to the utmost. As to the use of electricity by means of the Falls of Niagara, his idea was to drive dynamic engines by water power in the neighbourhood of the Falls and then to have conductors to transmit the force to the places where illumination or the development of mechanical power was wanted. There would be no danger of terrible effects being brought about accidentally by the use of such a terrific power, because the currents employed would be continuous and not alternating." This may be called a fanatical view of the electric light.

ON Tuesday night the electric light was put to rather a novel use, and one well calculated to test its practical and especially artistic value. At the Horticultural Society's *conversazione*, various forms of the light were adjusted so as to illuminate the magnificent array of fruit and flowers of all kinds and colours, with, we believe, complete success, the only drawback being the wretched state of the weather. Still it was clearly shown how admirably adapted this form of light is to any purpose in which it is essential that colours should be shown almost *au naturel*.

ON Monday evening Mr. J. F. Bateman, president of the Institution of Civil Engineers, received at a *conversazione* at the South Kensington Museum a large assemblage of distinguished representatives of science, literature, and art. The long galleries of models of machinery and naval architecture were thronged with eight or nine hundred visitors, and brilliantly illuminated with electric lights, presenting a scene of exceptional brilliancy. The electric lights employed were of many different systems, including the Jablochko candle, Siemens's apparatus, that of the Electric Lighting Company, fitted with Wilde's automatic carbon holders, Higgins's incandescent light, and many others, displaying both covered and naked lights. Many noteworthy models of machinery had been specially added for the occasion by well-known engineers. Among these new contributions, which attracted a constant succession of interested groups of visitors, were in particular a working model of the writing telegraph of Mr. Cowper, and Dr. W. H. Coffin's modification of M. Trouve's minute electric lamp for surgical use. These, however, were only two among the numberless objects claiming attention in an exhibition full of interest and instruction.

As usual the Geologists' Association have arranged an excursion for Whit Monday and Tuesday. This year it is to Bath, under the direction of Messrs. Charles Moore and W. H. Huddleston.

MOUNT ETNA is in a state of eruption; on the 26th an opening occurred on the northern side, from which issued dense volumes of smoke and flames.

THE administration of the scientific exhibition to be held at Paris from July to November next, is desirous to establish a special section of electricity if agreeable to intending exhibitors, consequently all the electricians who have subscribed already are requested to state their opinion.

A ZOOLOGICAL SOCIETY of New South Wales has been formed at Sydney; one of its chief objects is the acclimatisation of foreign animals.

THE Midland Union of Natural History Societies held its second annual meeting at Leicester on Tuesday and Wednesday,

May 20 and 21, under the presidency of Mr. Geo. Stevenson, who delivered an address to the large body of members from all parts of the Midland Counties, who met together in the Town Hall, Leicester. He pointed out how the usefulness of the Union might be best developed, and urged the members to co-operate together in definite efforts to solve some of the many problems of local and scientific interest. The first work of the kind which some of the societies had already taken up was an examination of the glacial drift deposits of the Midland districts, a scheme for which had been published by Mr. W. J. Harrison, F.G.S., one of the secretaries of the Union, in the *Midland Naturalist*. In due time the results of these efforts would be made public, and from what was already known of the labours of the inquirers some valuable information will be published. The Union now includes twenty-four societies, and there were representatives present from most of them. The societies in the Union (numbering nearly 3,000 members) are the following:—Birmingham Natural History and Microscopical Society, Birmingham Philosophical Society, Birmingham and Midland Institute Scientific Society, Birmingham School Natural History Society, Burton-upon-Trent Natural History and Archaeological Society, Caradoc Field Club, Cheltenham Natural Science Society, Derbyshire Naturalists' Society, Dudley and Midland Geological and Scientific Society and Field Club, Evesham Field Naturalists' Club, Leicester Literary and Philosophical Society, Northampton Naturalists' Society, Nottingham Literary and Philosophical Society, Nottingham Naturalists' Society, Rugby School Natural History Society, Oswestry and Welshpool Naturalists' Field Club, Peterborough Natural History and Scientific Society, Severn Valley Naturalists' Field Club, Shropshire Archaeological and Natural History Society, Small Heath Literary and Scientific Society, Stroud Natural History Society, Tamworth Natural History, Geological, and Antiquarian Society, Woolhope Naturalists' Field Club. In the evening of the first day a most successful *conversazione* and exhibition of microscopes, scientific apparatus, experiments, &c., was held in the Leicester Museum buildings. On Wednesday about 200 members made an excursion to Charnwood Forest, which was divided into two sections—one, geological, under the guidance of Mr. W. J. Harrison, F.G.S., and the other botanical, of which Mr. F. T. Mott, F.R.G.S., was the leader. The annual meeting in 1880 was fixed to be held at Northampton under the auspices of the Northampton Naturalists' Society; Mr. Edward W. Badger (Birmingham), and Mr. G. C. Druce (Northampton) were elected hon. secretaries for the year; and Mr. H. E. Forrest (Birmingham) assistant hon. secretary.

WE are pleased to see that a Scientific and Historical Society has been formed at Launceston, under the presidency of the Rev. G. H. Hopkins. From the opening address of the president it is evident that the Society has formed a correct idea of what should be the work of a local society, and we trust that the members will work energetically together to carry out the programme thus sketched. The district covered by the Society may be said to include North-east Cornwall and North-west Devon between Dartmoor and Bodmin Moor, with the sea-coast on the north. The sections are archaeology, botany, meteorology, zoology, and geology, and in all departments the district ought to yield rich fruits. The Society seems to have made a good start, and we shall watch its progress with interest. We trust it will enlist a large proportion of real workers.

AN interesting experiment was made on May 22 before M. Tresca, the sub-director of the Paris Conservatoire des Arts et Métiers. M. Chretien, an engineer of Paris, has constructed a set of two locomotive ploughs worked by rope traction according to the Fowler system. But instead of using steam power, M. Chretien has employed the electric current generated by a Gramme machine, and a stationary steam-engine. It has been

determined by M. Tresca that one-half of the motive power generated by steam was really transferred to a distance of above one kilometre from the furnace. The motive power which has been utilised for farming land can be employed for excavating, or executing any description of work.

THE carrier-pigeon service is now in full operation in France, and has been placed under the direction of the head of aerial communication. The number of birds fed by the Government is 6,000. These pigeons are located in Paris and twelve other large fortified towns. A number of soldiers and officers have been taught the art of pigeon breeding, and carriers are constantly sent from place to place. The Minister of Public Instruction and the Minister of Agriculture have established prizes for pigeon races.

THE strong interest recently awakened in Owens College, Manchester, has been shown in a desire on the part of some of his admirers to do honour to the founder. This has taken the form of a memorial window, which is to be erected in St. John's Church, near the College; and the donors have commissioned Mr. W. G. Taylor, of Berners Street, to carry out the work, which will be completed towards the end of next month. At the foot of the three lights are the words "Ars, Religio, Scientia," symbolised by subjects illustrating music, charity, and astronomy. The arms of the College and of John Owens occupy the bases of the side lights.

ONE of the new Cardinals, Haynald, Archbishop of Kalocsa in Hungary, is eminent as a botanist, as we learn from the *Gardeners' Chronicle*, and is probably the first botanist who has ever held so exalted a rank.

THE Sanitary Institute of Great Britain has issued a very satisfactory second Annual Report.

WE note that Dr. W. G. Farlow, for the past five years Assistant Professor of Botany at the Bussey Institution, Harvard University, has been appointed Professor of Cryptogamic Botany in the University proper. This is the first professorship in this important and difficult department established in the United States. The laboratory for instruction and research in the lower cryptogamia is now established at Cambridge.

FOR the schools of California, "A Popular Californian Flora; or Manual of Botany for Beginners," has (in part) been lately published by Mr. Volney Rattan, teacher in the Girl's High School, San Francisco. A second part will complete it. It is restricted to plants of the San Francisco region, extending north to Mendocino County, south to Monterey, and west to the foot hills of the Sierra Nevada.

"CINCHONA CULTURE IN BRITISH INDIA" is the title of a useful pamphlet by Surgeon-Major G. Bidie, Superintendent of the Madras Central Museum, being one of the Museum Popular Lectures of the season 1878-9.—We have received a separate copy of a paper "On Pollen," by Mr. M. S. Evans, read before the Natal Microscopical Society on November 18 last.—The Fifth Report of the Boulder Committee of the Royal Society of Edinburgh contains notes on a considerable number of boulders in Scotland, with numerous illustrations.—West, Newman, and Co. publish a monograph by Mr. P. H. Gosse, F.R.S., on "The Great Atlas Moth of Asia (*Attacus atlas*, Linn.)," with a coloured plate of its transformations.—We have received a very favourable Report of the Condition and Progress of the Davenport (U.S.) Academy of Natural Sciences, which is now in its eleventh year, and doing good and varied work.—"On the Lancashire Coal Fields," is the title of a paper by Mr. C. E. De Rance, reprinted from the *Proceedings* of the Geologists' Association.—A fourth edition of Bloxam's "Laboratory Teaching" has been issued by Messrs. Churchill. The most important alteration is the introduction of the formulæ repre-

senting the various chemical compounds described in the notes in the tables.

THE additions to the Zoological Society's Gardens during the past week include a Grey-cheeked Monkey (*Cercocebus albigena*) from West Africa, presented by Mr. Robert Surry; a Patagonian Sea Lion (*Otaria jubata*) from the Falkland Islands, presented by Mr. F. E. Cobb; a Roseate Cockatoo (*Cacatua roseicapilla*) from Australia, presented by Mr. Head; a Blue-winged Green Bulbul (*Phyllornis hardwickii*) from India, presented by Mr. A. Jamrach; two Horned Lizards (*Phrynosoma cornutum*) from Texas, presented by Mr. E. Loder; a Javan Fish Owl (*Ketupa javanensis*) from Java, a Ceram Lory (*Loriurus garrulus*) from Moluccas, three Abyssinian Guinea Fowls (*Numida ptilorhyncha*) from Abyssinia, a Nicobar Pigeon (*Caloenas nicobarica*) from the Indian Archipelago, a Victoria Crowned Pigeon (*Goura victoria*) from the Island of Jobie, a Mace's Sea Eagle (*Haliaeetus leucoryphus*) from India, two Black-tailed Godwits (*Limosa melanura*) twelve Common Widgeons (*Mareca penelope*), European, purchased; a Cheetah (*Felis jubata*) from Africa, two Bactrian Camels (*Camelus bactrianus*) from Central Asia, deposited; two Black Swans (*Cygnus atratus*) from Australia, received in exchange; two Chinchillas (*Chinchilla lanigera*), a Black-necked Swan (*Cygnus nigricollis*), bred in the Gardens.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE

FROM No. 6 of the *University College School Magazine* (London) we see that the editor's post is not altogether a pleasant one, though the number is very creditable. The U.C.S. Scientific Society seems in a healthy condition. In connection therewith we notice that a series of sixteen lectures are to be given during this term on the Science of Daily Life. We trust they will be well attended.

FROM the Report for 1878 of the Rugby School Natural History Society we learn that it is fairly flourishing. The entomological, geological, and archaeological sections have been vigorous, though the workers in each are fewer than they should be. Altogether there does not seem to us to be that hearty interest in the Society among the boys that conduces to complete success; all the more reason, therefore, for the real working members keeping up their work with unflagging zeal and doing their best to enlist the sympathy and help of the indifferent. A satisfactory observatory Report from Mr. Seabroke is appended.

SOCIETIES AND ACADEMIES LONDON

Royal Society, May 1.—"On the Origin of the Parallel Roads of Lochaber, and their bearing on other Phenomena of the Glacial Period." By Joseph Prestwich, M.A., F.R.S., F.G.S., &c., Professor of Geology in the University of Oxford.

Of the various hypotheses that have been brought forward since the time of Macculloch and Dick-Lauder in 1818, to account for the origin of the Parallel Roads of Glen Roy, the one so ably propounded by Mr. Jamieson, in 1863, has been most generally received and adopted.¹ It is a modification of the views originally expressed by Agassiz, to the effect that the barriers of the lakes—to the shore action of which both the above-named geologists attributed the "roads," but were at a loss to account both for the formation and removal of barriers—had been formed during the glacial period by glaciers issuing from Glen Treig and Glen Arkaig, supplemented by others from Ben Nevis. The subsequent determination, by the Scotch geologists, of an intermediate milder period succeeded by a second cold period, led Mr. Jamieson, with whom the pre-glacial and glacial deposits of Scotland had been a subject of especial investigation, to conclude that the extension of these two places took place during the second cold period, which he thinks was of little less intensity than the first, and that, while the glacier from

¹ Darwin's well-known paper, in which he considered the "roads" to be old sea-beaches, appeared in the *Philosophical Transactions* for 1839. This marine hypothesis was afterwards earnestly advocated by R. Chambers and Prof. Nicol, but is no longer held by its distinguished author.